How to create an E-Advertising Domain Model: the AEADS approach

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Abstract—**E-advertising is an increasingly profitable industry that continues to grow rapidly year upon year. Correspondingly, the number of people accessing the internet each year continues to rise. However, users respond negatively towards web based advertising campaigns; a prior study suggests that businesses should consider personalized web based advertisements as key to maximising the effectiveness of advertisements on their target customers. To this end, we are developing a toolset to support both authors and customers of adaptive advertising. Whilst personalisation is desirable, the creation of such systems is non-trivial. Thus, in this paper, we introduce a domain model tool, which is the main tool for authoring adaptive advertisements. It can be used by business owners to organise, label and categorise advertisements. Moreover, this tool has been evaluated by companies in the United Kingdom and Saudi Arabia.**

Keywords-E-advertising, E-commerce, Personalisation, Adaptive Advertising, Domain Model, Authoring System.

I. INTRODUCTION

E-advertising experienced a market growth rate of 18% over 2011 and 2012, and as, e.g., the Interactive Advertising Bureau [12] has shown, the industry's income expanded from $7.8bn to $9.26 in this period. It is thus clear that e-advertising is a sector experiencing significant growth [12].

Initially, websites were split between online retailers and those which displayed other content but generated revenue through advertisements. These advertisements were usually simple banners during the late 1990s. Nevertheless, sites have now realised they can make more profits by collecting demographic information about their users through subscriptions. Indeed, the methods used to grab the attention of users have become more aggressive – advertisements now use sounds and even objects that cover the screen. Perhaps unsurprisingly, the frustration that users often feel when confronted with these adverts has led to the development of a range of advert-blocking software [2].

Studies suggest that websites offering personalized content attracted 80% of Internet users to the sites they visited since 2005 [7]. From this, an opportunity has opened up for personalised electronic advertisements. In order to achieve this, it is necessary to monitor the online behaviour of individuals, ensuring that targeted advertisements reach them in the most effective way.

Thus, the main questions this research aims to address are:

1) How can we support the creation of adaptive advertising by website owners?

a) What type of tools do website owners need to be able to efficiently add adaptive adverts in a lightweight manner (as an add-on) to their website?

b) What kind of support do website owners need to be able to use these tools?

This paper responds to the questions above in a constructive manner, by proposing a set of tools for creation and authoring of adaptive advertising. It then focuses on the main tool of this toolset, the domain model tool, which it implements and evaluates with the help of real business owners.

The following sections discuss related research, domain model implementation and evaluation and provides a conclusion and description of future work.

II. RELATED RESEARCH

Closely related fields are that of authoring of adaptive hypermedia. Adaptive hypermedia systems [4] represent an opportunity to increase personalisation, supplying users with reports on matters within specific areas of interest. This technology helps customers by improving the efficiency and accuracy of the delivery of information [4]. When links provided to other websites or content are altered for the individual, in order to create a more tailored experience, this is referred to as adaptation. The different types of adaptation are referred to as 'navigational' and 'presentational' [15]. An authoring system is a computer-based system used to create, e.g., adaptive web content [9]. Most authoring system for adaptive hypermedia use separate tools for creating domain model (DM), goal and constraints model (GM), user model (UM), adaptation model (AM) and presentation model (PM) [11].

Along with the user model, the domain model is considered one of the main parts of adaptive hypermedia. It is used to describe and categorise all the information content and knowledge accessible in the hypermedia. In general, the structure of the domain model in hypermedia systems are either

hierarchical authoring models, or graphical models [5] that represent pieces of knowledge.

In [1] a hypertext document that automatically adapts to the ability level of the reader uses a simplified form of the domain model without any links between concepts. By contrast, in [8] the domain model contains a hierarchy of concepts, along with details of the attributes and relations between these concepts.

[6] introduces an Adaptive Web Content Delivery System then the domain is all web contents on the internet. With respect to domain model in advertising adaptation systems, the domain model must be representing the available advertisements. In addition, these advertisements must be categorised and divided into groups and subgroups.

For interoperability with other systems, such as delivery systems, or other authoring systems, some of the adaptive hypermedia systems have proposed using semantic web languages (mainly XML) for the internal representation of the various authoring tools [10, 16]. For this reason, XML was also used as internal format for the tool presented in this paper.

III. AUTHORING TOOL FOR E-ADVERTISING

A. The overall authoring of adaptive e-adverts

1) Domain model that can be used by business owners to organise, label and categorise advertisements, which will be described below.

2) Adaptation model, which will enable businesses to adapt the advertisements they have organised using the domain model tool to their customers' needs. The model, described elsewhere [14], is not further detailed here.

B. The domain Model

The domain model is the one of the main two tools of the AEADS authoring toolset. It includes data and advertisements and how they are organised and classified. The domain model includes groups and subgroups and the end of the leaves are the links to the organised advertisements as can be seen in Fig.1. These are the advertisements that will be allocated on the website host.
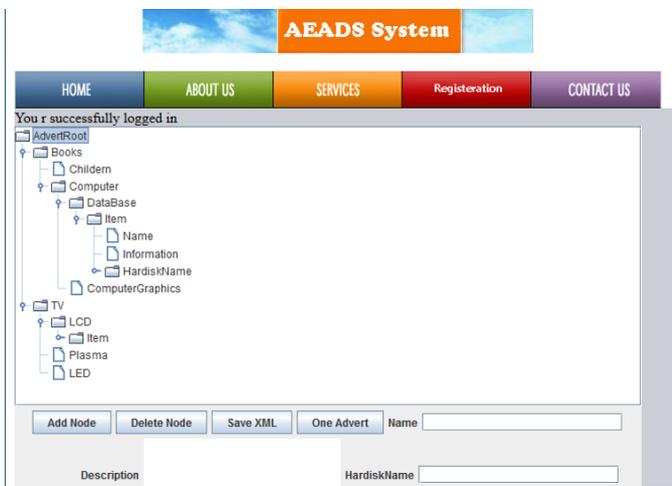

Figure 1. Domain Model Creation

The adverts appear to the business owner as a graphical tree from which to organise and classify ads in simple way. Groups and subgroups can be added and deleted. In addition, each item or advertisement will include a property name, a description and a hard disk name, which will indicate the advertisement's name, any information about the advertisement and the advertisement's name on the hard disk respectively. For internal storage and exportability, an XML file is created for each business owner who wants to organise the advertisements through our system upon registration, as shown in the example in Fig. 2.

Figure 2. XML Sample

IV. CASE STUDY

A. Hypotheses

The following hypotheses have been written to evaluate the domain model tool:

H1: The tool is important for our business.

H2: The GUI of the tool is attractive.

H3: The tool makes our work easier

H4: The tool is sufficient for creating and organising all of our advertisements

H5: The tool saves us time

H6: The tool can be used by any website to create and arrange advertisement domains

H7: New staff can understand and use this tool with minimal training

H8: The domain model home is useful and easy to use

H9: Registration is useful and easy to use

H10: Login is useful and easy to use

H11: The creation functions are useful and easy to use

These hypotheses were tested by surveying selected businesses and analysing their responses, as described below.

B. Case Study Setup

The domain model has been tested and a questionnaire has been created, based on implementation and the hypotheses, for business owners to evaluate its ease of use and utility.

The domain model tool was presented to twelve business owners for evaluation, selected especially from a variety of company types. The procedure was as follows.

Firstly, they were informed about the system as a whole, as well as to the idea of adaptive advertising in general. At the end of this presentation, we asked each business owner to use the tool. Then, we asked them to fill in a questionnaire, which included four parts. The first part concerned demographic information. The second part consisted of general questions about tool usability and to what extent the business owners agreed that this tool is important and it makes their work easier. Likert scale [13] questions were used in the third part to get business owners' feedback on tool features and functions, which can be seen in Table 1, and which are further used in Figures 6 and 7. The Likert scale used in this study took the format of a five point Likert scale. Respondents were asked to choose from five answers evaluating the tool's usefulness and ease of use with 1 being not useful at all or very hard to use, and 5 being very useful or very easy to use, respectively. The last part of this questionnaire consisted of open question to obtain any further comments the owners may have had.

TABLE I.   KEY FEATURES AND FUNCTIONS

A	Domain Model - Home	K	Login Process
B	Registration	L	Reset Password
C	Login	M	Adding Category - Subcategory
D	Creation Functions	N	Removing Category - Subcategory
E	Logout	O	Adding Advertisement inside subcategory
F	Registration Process	P	Adding Advertisements Name
G	Sufficient Data	Q	Adding Advertisements Description
H	Reset Information	R	Adding Advertisements file name
I	Submit Information	S	Saving the Tree into XML
J	Creating Account	T	Load the XML file(Domain Model) as tree

C. Results

Responses were obtained from businesses in the communication, construction, consulting, media, online education, trading, training and transportation industries (see Table 2). A total of 42% of businesses were classified as small, 33% as large and 25% as medium-sized enterprises (see Fig.3). A total of 58% of the businesses were located in Saudi Arabia and the remaining 42% in the United Kingdom (see Fig.4).

TABLE II.   TYPE OF BUSINESS

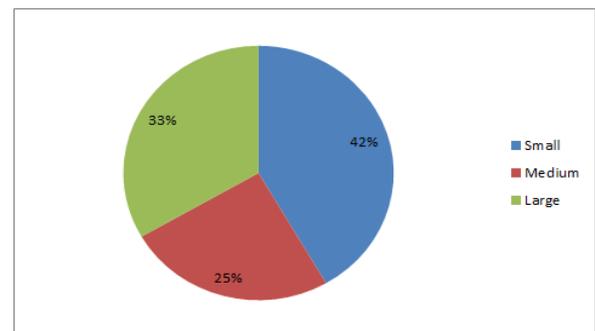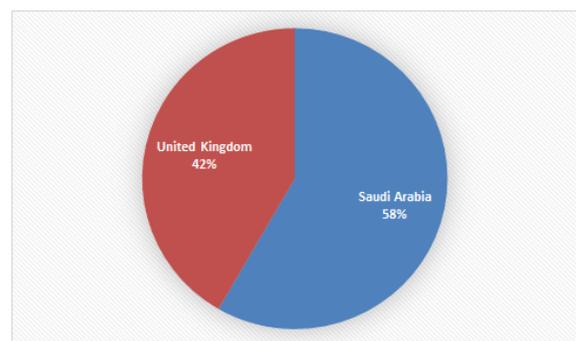| Type of businesses	Number
Communication	3
Constructing	1
Consulting	2
Media	1
Online Education	1
Trading	2
Training	1
Transportation	1
Total	12

Figure 3.   Size of Business

Figure 4.   Country

The general questions section included seven questions, alternating between positive and negative tone, to eliminate any bias that could be introduced by the questionnaire [3]. As can be seen in Fig.5, all businesses agreed that the tool is important for their business and makes their work easier in terms of organising their advertisements. In addition, they strongly agreed that the domain model tool saved them time and new staff could understand and use it with minimal training.
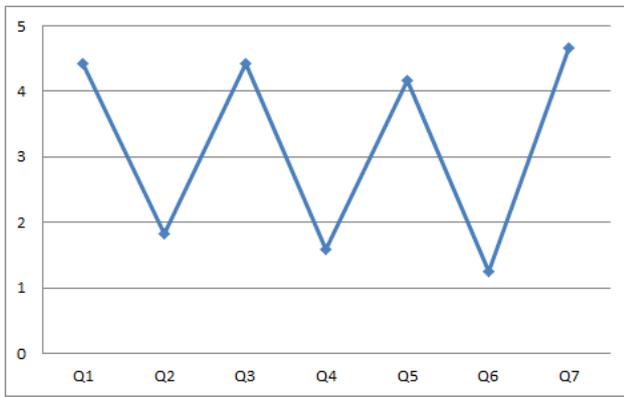
Figure 5.   General Questions

As shown in Fig.6, businesses responded to Likert scale usefulness questions for each of the domain model tool's specific features and functions. Following the analysis and tabulation of the data, it can be seen that each of the domain model tool's twenty elements rated very highly. Overall, the results were shown to be between 4 and 5, meaning that the tool is useful, with 4 indicating that a feature or function was useful and 5 indicating that a feature or function was very useful. Scoring highest in terms of usefulness were the registration process and creating an account with the login process following close behind. The lowest scoring features of the domain tool were the reset information and domain model home, although both elements still scored above 4. The possible reason for this is that the implementation of GUI was not complete. So, they felt that these functions are not useful enough. The mean values were greater than 3, all of them were between 4.08 and 4.91, which means the tool is easy to use. The standard deviation values were between .29 and .79.
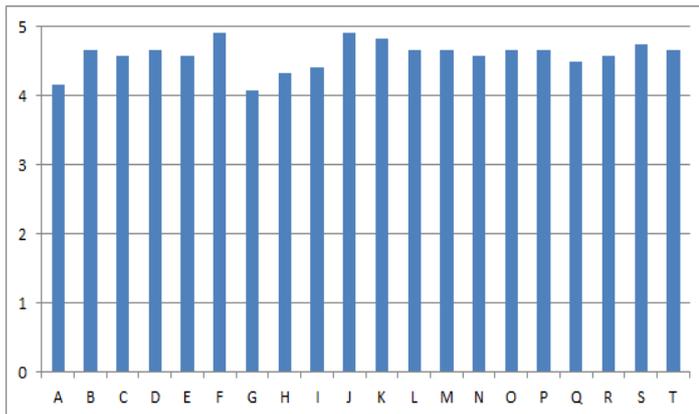

Figure 6.   Usefulness (Ox axis detailed in Table 1)

The Likert scale ease of use items were responded to positively by businesses for all of the features and functions of the domain model tool, revealing that it is easy to use, as seen in Fig.7. As with the usefulness items, the ease of use items addressed each of the twenty features and functions of the domain model tool. Again, each feature and function received a score of between 4 and 5. Following the analysis of the data collected in the questionnaire it was shown that registration, login and the registration process all scored perfect 5s. Loading

the XML file (domain model) as a file scored lowest but still scored above 4 as it takes a few more time to be loaded, indicating that it was easy to use. These figures, and those recorded above, are very encouraging regarding the future of the domain model tool. Moreover, The mean values were between 4.25 and 5.00 and the standard deviation values were between .00 and .75. The tool is easy to use as the mean values were all greater than 3.
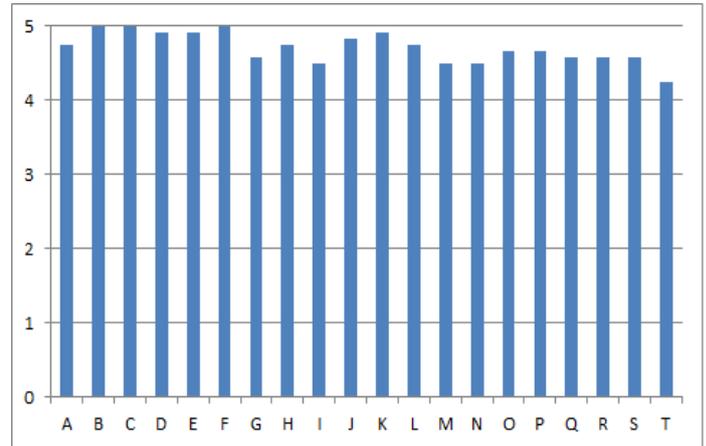

Figure 7.   Ease of Use (Ox axis detailed in Table 1)

From the open questions, we note that business owners want to improve the interface of the tool stating that we should: "Improve the GUI, add the actual ads and a preview / Thumbnail" and "It could be more flexible such as changing colours because the colours are very important with advertisements". In addition, owners want the opportunity to write instructions on the first page. Moreover, they were worried about the problems that they may face during the classification process. For example, one wrote: "Is there a support category within this web tool to help the users if they face a problem?" and "If I make a mistake during the classification process and I want to add another subgroup I have to delete items and add this subgroup and re-add items which is a waste of time". The responses to the open questions are very valuable for the furtherance of the domain model. The open questions allowed business owners to make comments outside the more structured elements of the questionnaire and to highlight issues that the researchers may not have been immediately aware of. This can then stimulate new ideas for the tool and will thus enable the researchers to modify the domain model so that it can reach its full potential and offer users the best possible solution for the organisation and categorisation of advertisements. For example, the suggestion to incorporate a support facility will improve user experience.

V.   CONCLUSION AND FUTURE WORK

We believe that an adaptive system will help businesses to increase their revenue by enabling them to send the appropriate advertisements to the appropriate customers at the right time. The first tool of the AEADS has been implemented to allow businesses to organise their advertisements inside groups and subgroups and to attach any necessary information for these advertisements, which makes their work easier and saves them

time. The features and functions of this tool have been tested. Furthermore, the tool has been evaluated by business owners and they have a positive attitude towards it with all of the features and functions of the domain model tool scoring between 4 and 5 on a Likert scale in terms of their usefulness and ease of use (with 1 being not useful all and not easy to use and 5 being very useful and easy to use). However, the open questions section of the questionnaire indicated some of the concerns that business owners had about and suggestions for the domain model tool which need to be addressed. The next tool to be included in this system will be an adaptation strategy tool which will enable businesses to adapt the advertisements they have organised using the domain model tool to their customers' needs. This will allow businesses to personalise their advertisements and target their promotional materials more effectively and thus increase their profitability.

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